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GAS ABSTRACTS

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1. GAS INDUSTRY

American Gas Association

Hendee, R. W. THE '49 GAS ROUNDUP. *Public Utilities Fortnightly* **44**, 531-533 (1949) *October* 27.

The 31st annual convention of the American Gas Association foreshadows the close of a most successful association year. Research conducted as part of the PAR plan has contributed greatly to this success. The promotion and advertising phases of the plan have stimulated sales of all types of appliances. The expenditure of some $1,000,000,000 for expansion during 1949 resulted in the addition of many new customers, and some 2 billion cu ft of new daily delivery capacity were added to the nation's pipe line systems.

J. C. Lane

Finances

Ely, O. FINANCIAL NEWS AND COMMENT. *Public Utilities Fortnightly* **44**, 583-591 (1949) *October* 27.

The stocks of large integrated gas systems have not shared in the rising trend of electric utilities during 1949. Disappointing earnings due to the relatively warm winter, the sharp decline in associated products such as natural gasoline, stock dilution through additional financing and other factors are cited as reasons for poor market performance. Uncertainty as to future Federal Power Commission policies is a potent factor.

J. C. Lane

Fuel Comparison

Holaday, W. M., Albright, R. E., Apjohn, T. L. and Steffens, L. R. FUELS—THEIR PRESENT AND FUTURE UTILIZATION. *Petroleum Processing* **4**, 1233-1244 (1949) *November*.

Current and future consumption of coal, petroleum and natural gas are surveyed together with their present utilization efficiencies in the major fields of use and potential measures for increasing these efficiencies. The highest thermal efficiencies are obtained in the application of these fuels for heating, average efficiencies for gas being 74%, for oil 66%, and for coal 53%. The lowest efficiencies (about 5%) are found in the field of transportation, a field which comprises some 32% of the nation's total energy consumption. Increased use of Diesel-electric locomotives is improving fuel efficiencies in transportation, but the major area for improvement is in automobile engine and transmission efficiencies. These improvements should be made without raising octane requirements or else the gain in reduced gasoline consumption will be offset by lower refinery yields. Trends in the utilization of the three fuels are estimated through 1950. Gas and oil consumption is expected to continue to increase relative to coal. Direct utilization of coal and gas is expected to prove preferable to conversion to synthetic liquid fuels until the remote time when the free play of economic forces dictates their synthesis. When that time comes, natural gas will probably also be limited and coal and shale oil will constitute the basic raw materials.

J. C. Lane

ELECTRIC UTILITIES SHIFT RAPIDLY FROM COAL TO OIL, GAS, REPORT SHOWS. *Natl. Petroleum News* **41**, 32 (1949) *November* 2.

The national consumption of fuels for the production of electric energy shifted during the 19-month period ending in July as follows: coal, from 79.4% to 63.2%; oil, from 10.0% to 13.8%; and gas, from 10.6% to 23.0%. The shift from coal and oil to natural gas was most apparent in Missouri figures for the same period: coal, from 73.9 to 62.8%; oil, from 21.1 to 5.7%; and gas from 5.0 to 31.5%. No gas is being used in New England for electric energy; practically negligible amounts are being used in the Middle Atlantic States; and only about 7.2% of the electric energy produced in the East North Central States comes from gas.

J. C. Lane

Governmental Regulation

Carlson, F. FPC'S BID FOR ADDED POWER OVER NATURAL GAS. *Public Utilities Fortnightly* **44**, 534-541 (1949) *October* 27.

The Federal Power Commission's attempts to regulate gas gathering by independent pro-

ducers on a public utility basis is influencing and may completely curtail the willingness of these producers to sell gas for interstate commerce. Such producers will hold their gas for sale within the producing state to obtain a return commensurate with their investments and the capital risks entailed in producing gas. It is alleged that the FPC is attempting to usurp regulatory functions rightfully performed by state commissions and, in so doing, is violating the states' rights provided in the Constitution. Legislation by Congress is sorely needed to clarify the situation.

J. C. Lane

Schoeppel, A. F. STATE AND FEDERAL RELATIONS AS TO CONSERVATION. *Public Utilities Fortnightly* **44**, 542-550 (1949) *October* 27.

The states and the Federal government should cooperate in regulations for conservation rather than joust for authority. Some functions by their nature must be handled by the Federal government. However, many functions are best performed by the states, consistent with the theory that the best government is that which is closest to the people. The fields for state and Federal regulation are discussed and some attempt made at a logical delineation.

J. C. Lane

Natural Gas

Hulcy, D. A. THE EXPANDING HORIZON FOR NATURAL GAS. *Pipe Line News* **21**, 16-17 (1949) *November*.

The network of natural gas transmission lines now measures more than 251,000 miles, with 8,500 more miles of big-inch lines under construction and some 14,600 miles pending Federal Power Commission approval. This network is delivering about three trillion cu ft of gas annually to the country's gas utility companies, or about half the total annual production of natural gas. Proved reserves total 174 trillion cu ft, and they have risen by 26.1 trillion cu ft during the last four years while total production over the same period amounted to 21.3 trillion cu ft. Potential reserves in Canada and off-shore on the Gulf and Pacific Coasts indicate many years of adequate reserves. House heating will constitute an increasing demand for natural gas. Of 19.75 million residential customers studied in a recent A.G.A. survey, 6 600,000 are now using gas for space heating while 693,000 more will become space heating consumers during the winter 1949-1950. Space heating by gas has reached 100% saturation in Kansas, Louisiana, Mississippi, Oklahoma and Texas while it stands about 96% in California. Ohio has reached 37% saturation with one company supplying gas for space heating to 51% of its 592,000 customers. With a possible saturation of over 50% in areas above 35° latitude, new horizons will be opened on problems of rates and public regulation, probably taking into account the cost of space heating service and the competitive position of gas with other fuels. Research is opening new vistas. The top burner required efficiency of gas ranges has been raised from 30% in 1924 to 40% in 1949 and efficiencies of 60% are reached by many ranges. Progress in the industrial heating field is exemplified by the malleablizing of iron fittings in which the heating cycle has been reduced from one week to 24 hrs., furnace size has been reduced to a quarter of that formerly required and gas consumption has been lowered by 70%. Catalytic gasification and high-Btu oil gas processes have been developed for meeting peak loads, and other processes such as fluid gasification are currently under study.

J. C. Lane

Petroleum

Salmon, J. H. PETROLEUM OUTLOOK THROUGH 1950. *Oil Gas J.* **48**, 233-234, 236, 374-375 (1949) *November* 10.

The demand for petroleum, now some 6,150,000 barrels per day, is expected to rise 6-7% in 1950 to some 6,550,000 bbls per day. Crude production is expected to increase by some 500,000 bbls per day to an average of 5,540,000 bbls per day, while refinery runs are expected to rise by the same amount to a total of 5,850,000 bbls per day. Gasoline demand will increase by some 5% to 2,730,000 bbls per day; and that for kerosene and distillates by 16% to 1,500,000 bbls per day. The demand for residual fuel is expected to increase to 1,390,000 bbls per day.

Some decline in exports is predicted and imports probably will exceed 650,000 bbls per day.

J. C. Lane

Whitman, W. G. LIQUID FUEL SUPPLIES AND NATIONAL SECURITY. *Petroleum Processing* 4, 1222-1232 (1949) *November.*

The probable liquid fuel requirements for another major war and the various methods for meeting them have been studied. Conclusions have been drawn as to the most promising measures to be taken. Reserve capacity for production should be fostered by research on better methods for finding oil, a high level of exploratory activity, restricting production from new fields, unitization of fields, determination of the maximum efficient rate of producing from existing wells, development of methods for increasing production efficiency and ultimate recovery, development of potential domestic and Canadian fields as emergency reserves and stockpiling of oil-field and pipe line steel. Other security measures include detailed planning for the immediate stock-piling of oil products at the start of the war, importing now as much oil as possible without seriously discouraging domestic exploration, private research on synthetic liquid fuels supplemented by basic government research and increasing refinery flexibility to permit higher distillate yields.

J. C. Lane

2. APPLIANCES

Burners

Harper, P. S. (assigned to Harper-Wyman Co.) GAS BURNER HAVING REMOVABLE CAP STRUCTURES. U.S. 2,486,278 (1949) October 25.

Nineteen claims were allowed for the construction features of an atmospheric burner which has a cap that may be easily removed due to the bayonet type of locking devices.

E. F. Davis

Lane, A. A. SAFETY CONTROL APPARATUS FOR GAS BURNERS. U.S. 2,484,301 (1949) October 11.

Seven claims are made for a gas range top burner automatic shut-off valve. A liquid-filled expansion bellows, actuated by the heat from the main burner, is employed to keep the gas valve open while the manifold gas pressure is employed as the counteracting means for keeping the valve closed. Failure of the flame due to drafts or spillage on the main burner will cause a reduction in the pressure of the thermostatic element permitting the gas pressure to exert a greater force thereby closing the valve.

E. F. Davis

Schickler, A. C. PILOT AND BURNER CONTROL. U.S. 2,483,939 (1949) October 4.

Five claims are made for a monometallic, mechanical safety pilot which will effectively cycle from an on to off position in less than 40 seconds. Special features of this design are its sensitivity, and the power developed as a result of the unique design.

E. F. Davis

Gas Efficiency

Prettyman, B. THE FACTS ABOUT GAS EFFICIENCY. *LP-Gas* 9, 25, 86-88 (1949) *November.*

Refutation is made to statements of electric competitors who greatly exaggerate the energy ratios for water heating, cooking and refrigeration. The electric companies claim ratios of 3 to 1 for cooking, 1.9 to 1 for water heating, and 10 to 1 for refrigeration.

E. F. Davis

Range

Kamin, G. W. (assigned to Cribben & Sexton Co.) STOVE CONSTRUCTION. U.S. 2,486,564 (1949) November 1.

Four claims were allowed for the construction features of a range broiler tray which has adjustments for tray height when the drawer is closed and is self elevating when the drawer is pulled open.

E. F. Davis

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Culshaw, G. W. and Garside, J. E. A STUDY OF AERATED BURNER FLAMES. p. 284

3. COMBUSTION AND INDUSTRIAL FURNACES

Burners

Culshaw, G. W. and Garside, J. E. INSTITUTION GAS RESEARCH FELLOWSHIP REPORT: 1947-1948—A STUDY OF AERATED BURNER FLAMES. Institution Gas Engrs. Comm. 346 (1949) October.

The authors' earlier concept of ignition velocity as a physical constant for a gas-air mixture is reaffirmed but it is qualified by the admission that for any one combustible mixture at a given pressure there exists a critical port diameter, above which the ignition velocity is independent of diameter and below which the ignition velocity falls with decreasing diameter. This conclusion applies to the ignition velocity measured on the bunsen flame by the "total-area" method. Experimental data indicate that the Lewis and Von Elbe theory of the critical velocity gradient applies more accurately to blow-off than to flash-back phenomena.

A. J. Rudnitzki

Flame Hardening

Furkert, P. A. GAS FLAME-HARDENING OF LARGE GEARS. *Gas* 25, 44-45 (1949) *November.*

A brief resumé is given of the application of gas to flame hardening large machine gears at a fuel and labor cost of less than one fourth of one cent per pound of steel treated. Some useful hints for gas sales engineers are included.

E. F. Davis

Steam Generation

Bogot, A. OPERATION AND MAINTENANCE OF STEAM GENERATING EQUIPMENT AS AFFECTED BY PROPERTIES OF FUELS. *Combustion* 21, 48-51 (1949) *October.*

Pulverized coal firing, stoker firing and gas or oil firing of boilers are discussed. For pulverized coal installations the factors which affect performance are grindability, moisture content, volatile matter, and ash content. For stoker firing the chemical analysis of the ash and the caking properties of the coal are important. In the case of fuel oil firing, the ash content and sulfur content are important factors.

W. J. Merwin

The following graph is also called to your attention:

SENSIBLE HEAT LOSS IN FLUE GAS—WOOD AND LIGNITE. *Heating and Ventilating* 46, *opposite page* 86 (1949) *November.*

4. CARBONIZATION AND GASIFICATION

Carbonizing Properties

Davis, J. D. and Reynolds, D. A. SURVEY OF CARBONIZING PROPERTIES OF AMERICAN COALS. (1948-1949). Paper presented at the American Gas Association Annual Convention, Chicago, Illinois, October 17-20, 1949.

The test program of Survey of the Carbonizing Properties of American Coals has been narrowed by limiting experimental tests to high temperature carbonization at 800 and 900°C. Other modified procedure consists in using 18-in. retorts only, and in using standard A.S.T.M. methods for tests of coke. Emphasis was directed to advance the current survey of coking coal reserves. Six low-volatile, four medium-volatile, and ten high-volatile coals were carbonized, singly and in blends with coals of different rank. These and 16 additional special coals and blends were tested in a sole-flue test-oven for expanding properties. Three coals and 1 blend were tested in the new 500 lb expansion oven. Tabulated data on desorption of test coals, analyses, physical properties of coke, yields of products and expanding properties are given.

O. P. Brysch

Coal Analyses

Averitt, P. ANALYSES OF IOWA COALS. U.S. Bureau of Mines Technical Paper 706 (1949).

This report is a revision of T.P. 269, which was the first of a series of 31 technical papers on analyses of U.S. coals by states. Descriptive data are given on the Iowa coal fields, mining

methods, coal preparation; and also statistical data on production, distribution and use up to 1944. Analyses of 215 mine, tipple and delivered samples are tabulated, with separate sections on description of samples, true specific gravity, and analyses of sulfur forms. The Mystic and No. 3 beds are the most important. Most Iowa coals are of high-volatile C bituminous rank, of fair caking properties, with a general average analysis of approximately 16% moisture, 35% volatile matter, 35% fixed carbon and 14% ash, and of 2.2 to 7.8% sulfur (1.7 to 4.8% pyritic). Heating value, moist basis, is from 8500 to 11,000 Btu per lb.

O. P. Brysch

Coal Structure

Bangham, D. H., Franklin, R. E., Hirst, W. and Maggs, F. A. P. A STRUCTURAL MODEL FOR COAL SUBSTANCE. *Fuel* (British) 28, 231-238 (1949) *October*.

This article serves to reintegrate much of the more recent published work of Bangham and his associates upon the micellar theory of the structure of coals. A simple model is presented for the structure of bright bituminous coals, based upon the geometry of 12 uniform spherical micelles clustered about a central micelle. As compaction takes place the spheres are forced closer together and are deformed, with decrease in volume of void spaces. By calculation from the original micellar radius and the deformed micellar radius, three parameters can be found: (1) the overall voids as a fraction of the overall volume of the cluster; (2) the free internal surface per unit weight; and (3) the diameter of the largest sphere which can penetrate the compacted cluster without causing distortion. These calculated results are then compared for coals of different rank, with experimental values of: (1) the porosity as determined from true density in helium and from approximate density of the lump; (2) the surface area per gram calculated from the heats of wetting in methanol; and (3) the dimensions of those molecules which are just too big to penetrate coal. The latter three experimental values determined earlier by Franklin for three coals which increase progressively in rank are shown to correspond well with the three calculated parameters if the mean micellar radius of 85 Angstrom units is used, and if a reduction of 0.05, 0.10, and 0.134 of this radius takes place in the 12-coordinated sphere model. Thus the changes with rank of three parameters, surface area, porosity and size of pore construction are expressed approximately by the single variable of *compaction* (or reduction of mean spherical radius). This model and hypothesis do not apply to anthacites, semianthracites and durains because of their high porosity. They explain further the fundamental importance of these structural parameters in the technical behavior of coals.

O. P. Brysch

Coke Oven

Hughes, C. H. (assigned to Hughes By-Product Coke Oven Corp.) BROAD COKE OVEN WITH TAR PREHEATER. U.S. 2,486,413 (1949) November 1.

A process for making a usable coke from coke breeze and tar is disclosed. The breeze is charged into a sole-heated, broad-type coke oven, and hot pitch is fed onto the coke charge. Coking of the mixture produces a coke suitable for water gas or domestic use. The oven has no regenerators, the hot flue gases being conducted around the boilers of overhead tar stills, by means of which moisture and tar oils are removed and subsequently recovered by condensation. The resulting pitch flows by gravity onto the breeze charge in the oven.

W. E. Ball

Fluid Coking

Rex, W. A. and Roetheli, B. E. (assigned to Standard Oil Development Co.) CONTROLLED SEVERITY FLUID COKING. U.S. 2,485,315 (1949) October 18.

Heavy oil is coked in a fluidized bed and the severity is controlled by injecting quenching solids above the dense phase bed. The quenching solids are at a temperature level sufficiently below that of the oil vapors so that the resultant temperature after quenching is below decomposition temperature.

W. J. Merwin

Gasification

Thomsen, A. M. METHOD OF GASIFYING CARBON AND THE LIKE. U.S. 2,486,582 (1949) November 1.

This patent is granted for a continuous process for gasifying carbon with mixtures either of CO and CO_2, or CO, CO_2 and H_2O at high temperature. The successive steps in the gasification process are (1) Storing heat in a refractory structure such as a regenerator. Two regenerators are provided and are heated alternately by suitable hot combustion products. (2) Transferring heat from regenerator to reactant gases such as mixtures of CO, CO_2 and H_2O. (3) Passing the heated reactant gases through a hot fuel bed whereby CO_2 is converted to CO and steam reacts to form CO and H_2, thereby cooling the gases by heat absorption in the endothermic gas making reactions. (4) Withdrawing a portion of the gaseous products as acceptable gas and recycling the remainder through regenerator and fuel bed, alternately switching regenerators so that one is heated while the other is cooled, thus making the process continuous.

C. Von Fredersdorff

Manufactured Gas

Kyle, R. LOW COST MANUFACTURED GAS. *Gas* 25, 29-33 (1949) *November.*

The new regenerative high Btu oil gas processes are discussed and their use for supplementing a natural gas base load is recommended on the basis of present heavy fuel oil and natural gas cost trends. A chart for estimating F.O.T.S. cost on a 1000 Btu basis for a 6% Conradson carbon residue oil in a regenerative oil gas set is presented. Based on these costs and considering the savings when purchasing natural gas on a 100% load factor basis the advantages of extensive peak shaving with high Btu oil gas are demonstrated.

H. R. Linden

Nuesse, E. C. TRENDS IN THE MANUFACTURED GAS INDUSTRY. *Public Utilities Fortnightly* 44, 566-576 (1949) *October* 27.

Spearheaded by the Institute of Gas Technology and the American Gas Association, considerable work has been done in the last few years in developing new methods and improving old ones to produce better and cheaper gas. The catalytic cracking process developed through A.G.A.-sponsored work at the Institute produces a carrier gas of about 240 Btu from light hydro-carbons which can be cold enriched with propane or butane to give a finished gas completely substitutable for manufactured or mixed gases. The Hall high-Btu oil gas process utilizes regenerative cracking of oils in the checkerwork of water gas machines, producing 1,000 Btu oil gases from oils containing up to 6% Conradson carbon. The Dayton-Faber process uses partial combustion of the charge with oxygen-enriched air to produce oil gases or reformed natural gases of 300-950 Btu. Experimental developments in the field of solid fuel utilization include underground coal gasification tests and laboratory and pilot-plant experiments on the gasification of powdered coal in suspension, the latter being studied by the Institute of Gas Technology, the Bureau of Mines and at least three private companies. Reductions in manufactured gas production costs may be expected from the use of natural gas for reforming. Holders, a relatively large factor in overall investment costs, are analyzed as to types best suited for specific applications and the comparative costs of the types.

J. C. Lane

Tars

Kinney, C. R. CHARACTERIZATION OF WATER GAS TARS. American Gas Association Gas Production Research Committee Research Bulletin 2, 20p. (1949) September.

The final results of "Tar Investigation" project PSC-1, sponsored by the Gas Production Research Committee of the American Gas Association are presented in bulletin form including a laboratory manual for the practical application of the new method of tar evolution developed through this study. The results of this work

were also presented at the Chemical Committee and Production Conference in May, 1949 (*cf Gas Abstracts* 5, 156 (1949) July).

H. R. Linden

Tonnage Oxygen

Wright, C. C. CURRENT STATUS OF TONNAGE OXYGEN. Paper presented at the American Gas Association Annual Convention, Chicago, Illinois, October 17-20, 1949.

The essential features of tonnage oxygen plants include means for cleaning the process air of dust and suspended material, cooling and removal of carbon dioxide and water vapor from compressed process air by reversing heat exchangers, obtaining additional refrigeration for liquefaction by expansion of the cooled air, fractionation of liquefied air, and cooling incoming process air by the cold oxygen and nitrogen products. These products are used to purge frozen carbon dioxide and water vapor from the exchangers and to remove dangerous acetylene concentrations from the system. The design of equipment and the nature of the operating cycle vary from plant to plant. Important factors to consider in evaluating a tonnage oxygen plant are: (a) cleaning efficiency and frequency of deriming the reversing heat exchangers; (b) ease of control of acetylene concentration in the fractionator; and (c) purity of the oxygen and utility of the nitrogen by-product. Depending on the design, present tonnage oxygen plants can deliver from 80 to 99.5% purity oxygen. The cost of producing oxygen of a given purity depends on the size of plant, power and labor costs and fixed charges, credits for by-products, and the load factor; all of these vary with local conditions. Probable costs for a 250 ton/day plant are approximately 4-5 dollars per ton (17-21 cents/Mcf), assuming a load factor of unity. A summary of reports from manufacturers is presented which indicates a rapid growth of tonnage oxygen plants.

C. Von Fredersdorff

Water Gas Manufacture

Macbeth, G. T. WASH BOX AND TAR SEPARATOR OF WATER GAS MANUFACTURING MACHINES. U.S. 2,485,835 (1949) October 25.

The wash box described is designed to cool and purify the hot gas and to separate lampblack and tar from the liquor. The gas enters the cylindrical tank tangentially through a seal pipe, imparting a swirling motion to the liquid content. After passing around baffles in the upper part of the chamber, the gas flows through an axial pipe to an exit at the bottom of the tank. A radial skimmer collects floating impurities (lampback), which are carried off by means of a seal pot. A complex system of baffles in the body of the liquid removes the tar, which then collects at the bottom of the tank. The swirling motion of the liquid is enhanced by pumping liquid from a low level and injecting it tangentially.

W. E. Ball

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Boniface, J. B. MAKING PLANS FOR SYSTEM OPERATION BY LONG AND SHORT TERM FORECASTING. p. 288

Boyer, E. G. PROBLEMS WHEN USING NATURAL GAS IN A MANUFACTURED GAS SYSTEM. p. 288

Clark, E. L., Kallenberger, R. H., Browne, R. Y. and Phillips, J. R. SYNTHESIS GAS PRODUCTION. p. 294

Fassina, L. SULFUR CONTENT OF SPENT OXIDE. p. 296

King, H. HOW LONE STAR HAS IMPROVED ITS GAS DISPATCHING. p. 288

Noyes, H. B. WASHINGTON GAS LIGHT SOLVES NATURAL GAS CONVERSION PROBLEMS. p. 288

Peabody, A. W. and Woody, C. L. EXPERIENCE AND ECONOMIC BENEFITS FROM CATHODIC PROTECTION ON GAS DISTRIBUTION SYSTEMS. p. 288

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Changeover

Boyer, E. G. PROBLEMS WHEN USING NATURAL GAS IN A MANUFACTURED GAS SYSTEM. *Gas Age* **104**, 24-30, 52, 54 (1949) *October* 27.

The author states the advantages and disadvantages attending the replacement of manufactured gas by natural gas. An outline of the manner in which his company plans to use natural gas is included.

J. D. Parent

Noyes, H. B. WASHINGTON GAS LIGHT SOLVES NATURAL GAS CONVERSION PROBLEMS. *Gas Age* **104**, 10-12, 56 (1949) *October* 27.

The postwar availability of Texas natural gas and a large increase in residential customers influenced the company to convert to the distribution of natural gas in place of 600 Btu carburetted water gas. One plant was dismantled and its equipment sold, while the other was converted to the manufacture of high-Btu oil gas for meeting peak loads. Maximum daily output was 100 Mmcf of 600 Btu gas in 1946 as contrasted with 133 Mmcf of 1100 Btu gas in 1949. Rates were changed from a volume basis to a therm basis. Conversion costs were met by bank loans and accelerated depreciation on the manufactured gas production facilities.

J. C. Lane

Distribution

Boniface, J. B. MAKING PLANS FOR SYSTEM OPERATION BY LONG AND SHORT TERM FORECASTING. Paper presented at the American Gas Association Annual Convention, Chicago, Illinois, October 17-20, 1949.

A method is given for predicting the total send-out which is based on the average daily temperature. A considerable amount of reliable data was collected for all classes of users and curves representing the data were plotted by the method of the least squares. Though temperature is not the only criterion affecting the load, the data was taken over a reasonably long period of time, thereby tending to cancel out the other variables.

E. F. Davis

King, H. HOW LONE STAR HAS IMPROVED ITS GAS DISPATCHING. *Gas Age* **104**, 90-91, 110 (1949) *October* **13**.

A temperature index curve which is used by Lone Star Gas Company to predict demand is described. To obtain the curve the daily demand was plotted against the arithmetic average temperature of the 16 hr. period from 6 A.M. to 10 P.M. substracted from 65. The company system has been divided into 13 curtailment zones, all but three of which are independent and may be curtailed as much as necessary without being unfair for not curtailing other zones.

O. T. Bloomer

Peabody, A. W. and Woody, C. L. EXPERIENCE AND ECONOMIC BENEFITS FROM CATHODIC PROTECTION ON GAS DISTRIBUTION SYSTEMS. *Corrosion* **5**, 369-376 (1949) *November*.

The experiences of two utility companies in applying cathodic protection are described. Reduction in number of leaks and lengthening of life of the underground pipe were the results. Sketches and descriptions are presented of rectifier units, installation specifications, and sacrificial anode installations. A table is presented showing the variation in current requirements for nine different locations. The range is from .021 to 1.24 amperes per mile of 3 in. equivalent pipe. The cost of installing cathodic protection varies with conditions, but it is usually less than 1% of the installed cost of the pipe.

W. J. Merwin

Peacock, P. E., Jr. BATTERY-CONTROLLED, HOLDERLESS PROPANE-AIR SYSTEM OPERATES FOR NEW YORK UTILITY. *Gas* **25**, 34-36 (1949) *November*.

Several propane-air systems have recently been installed which utilize electric batteries as a source of current to operate the control system and thus make the units independent of any power failure. The control system has been

perfected so that the unit can supply gas directly into the distribution system without benefit of a holder.

O. T. Bloomer

Holders

Hough, F. A., Mosteller, W. C. and Randall, R. O. HOLDERS: CONVENTIONAL, PIPE, AND BOTTLE TYPES. A STUDY OF COMPARATIVE COSTS. *Gas* 25, 39-42 (1949) *November.*

The results of an engineering and economic study to determine the effect of operating variables on the cost of conventional gas holders versus high pressure pipe and bottle holders is presented. The installed costs for pipe and bottle holders on standby service falls within the range of $49 to $93 per Mcf capacity while conventional holders fall within the range of $187 to $260 per Mcf. The total annual costs would be $7.80 to $14 per Mcf per year and $26 to $36 per Mcf per year respectively. Graphs are presented to show the effect on costs of the cycles of operation per year, the operating pressure and the design formula used in the design of the high pressure pipe or bottle holders.

O. T. Bloomer

LP-Gas

Clifford, E. A. A PRACTICAL GUIDE TO LP-GAS UTILIZATION. PART VIII. GAS METERS. *LP-Gas* 9, 36-38, 40, 42, 44, 48, 50 (1949) *November.*

Elementary facts about standard LP-gas meters are discussed.

E. F. Davis

Natural Gas-Air-Nitrogen Mixtures

Jones, G. W., Kennedy, R. E. and Spolan, I. EFFECT OF HIGH PRESSURES ON THE FLAMMABILITY OF NATURAL GAS-AIR-NITROGEN MIXTURES. U.S. Bureau of Mines Report of Investigations 4557 (1949) November.

The effect of pressure on the limits of flammability of natural gas-air-nitrogen mixtures was determined from atmospheric pressure to 3000 psi. The lower limits of flammability of natural gas-air mixtures was found to change very little with pressure while the upper limit increased from 14.2% air by volume at atmospheric pressure to 60.0% at 3000 psia. The effect on the flammability limits of adding nitrogen to natural gas-air mixtures was also evaluated. It was concluded that the following percentage value of oxygen must not be exceeded if explosions are to be prevented: atmospheric pressure, 12.0%; 1000 psi, 9.0%; 2000 psi, 8.5%.

O. T. Bloomer

Natural Gasoline

Sanderson, C. F. and Glendening, A. S. ECONOMICAL GASOLINE-PLANT DESIGN. *Oil Gas J.* 48, 66-68, 80, 83 (1949) *October* 27.

The authors stress the necessity of picking the most favorable process of liquid recovery and illustrate this principle for a particular gas. It is also indicated that the maximum profit need not coincide with minimum investment and that the availability of funds must be considered.

J. D. Parent

Pipe Lines

Farrell, J. F. ABRASIVE BLASTING PREPARES PIPE SURFACES FOR CASTING. *Petroleum Engr.* 21D, 34-36 (1949) *October.*

The equipment and method of blast cleaning pipe are briefly described.

O. T. Bloomer

Millen, J. A. REPAIRING LEAKS ON THE CALIFORNIA SECTION OF THE TEXAS PIPELINE. *Gas* 25, 83-84, 88, 90 (1949) *November.*

Methods used to repair small leaks in the 30 in. Texas pipeline are described. Small pinholes were repaired by peening with a center punch. Larger leaks were repaired by arc welding vented sleeves over the leaks with line at normal pressure. Full 360° welding sleeves rather than patches were used. The procedure for making an all welded repair of the leak using a special nipple with a plug is described. A method for installing corrosion coupons and a siphon drip in a line under pressure is also described.

O. T. Bloomer

Stormont, D. H. NEW METHOD FOR INTERNALLY CLEANING AND COATING PIPELINES IN PLACE. *Oil Gas J.* **48**, 66-67, 87-88 (1949) *November* 3.

A new method of internally cleaning and coating pipe lines up to 10 in. diameter and larger and lengths up to 10 miles per treatment is described. The cleaning medium consisting of petroleum solvent and steel cutting or swabs are propelled through the line between two rubber plugs using compressed air as the propellant. The primer coat and plastic top coats are propelled through the line in a similar manner. Coating thicknesses of 4 to 5 mils in two applications are obtained. Leaks in badly corroded pipe are sealed by the coating. Considerable data on the equipment employed, cleaning procedure, and coating methods are included.

O. T. Bloomer

RAPID PROGRESS BEING MADE ON TRANSCONTINENTAL LINE. *Gas Age* **104**, 16-17, 50, 52 (1949) *October* 27.

This is a progress report on the construction of the line from the Rio Grande Valley to New York. Many interesting data are given.

J. D. Parent

Production

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS: FORMATION RESISTIVITY AND HYDROCARBON CONTENT. *Oil Gas J.* **48**, 379 (1949) *November* 10.

The relationship between hydrocarbon content and resistivity factor are briefly discussed. The relationship is based on the assumption that the hydrocarbon does not transmit current and that therefore the resistivity depends on the connate water content only.

O. T. Bloomer

Rall, C. G. and Taliaferro, D. B. A BUREAU OF MINES METHOD FOR DETERMINING POROSITY: A LIST OF POROSITIES OF OIL SANDS. U.S. Bureau of Mines Report of Investigations 4548 (1949) September.

This report covers in detail the Bureau of Mines method for determining porosity. The apparatus has been improved but the procedure is the same as described in the Bureau of Mines Report of Investigations No. 3352, 1937. Recent improvements include an improved pycnometer for measurement of the bulk volume of the test specimen and more accurate methods of pressure measurement. A tabulation is given of more than 2,000 porosity determinations for oil sands in the fields of 13 states.

O. T. Bloomer

Smith, S. DELIVERABILITY METHOD OF RATING GAS WELLS. *Oil Gas J.* **48**, 61-62, 80 (1949) *October* 27.

Deliverability is defined as the ability of a well to produce gas into a pipe line. It is expressed as daily rate of flow. In Kansas, Oklahoma and Texas the methods of well testing are essentially the same. Caution is recommended. A wellhead working pressure of 80% of the shut-in value is to be used for the Hugoton field. An illustrative calculation for deliverability is given. Use of single point flow rate into a pipe line means conservation and ease of testing. Tests on Panhandle wells indicate great variation between potential as calculated by usual back pressure tests and deliverability at 90% of the shut-in value. A well can have a high potential and low deliverability to a pipe line so that the latter property is preferable in proration regulations.

J. D. Parent

Stormont, D. H. WATER CONSERVATION. *Oil Gas J.* **48**, 58-60 (1949) *October* 27.

Water conservation was a prime consideration in the design of Sun's new West Texas pressure maintenance plant. Approximately 90% of the cooling and condensing load is achieved with radiator fan type coolers, a single cell cooling water tower being required for third stage gas and the overhead streams of the debutanizer and deethanizer.

J. D. Parent

GAS TURBINE GASOLINE PUMPING UNIT. *Southern Power & Ind.* **67**, 66-68 (1949) *November*.

A rather complete description is given of the mechanical features of the 2000-hp gas turbine gas line pumping unit recently installed by Mis-

sissippi River Fuel Corporation. The unit was built by Westinghouse and has been on test by the manufacturer since 1946.

O. T. Bloomer

Abstractor's Note: The title of the article is somewhat confusing. The gas turbine is used to drive a natural gas pipe line booster not a gasoline pump.

Purification

Stanley, C. P. (assigned to Phillips Petroleum Co.) ABSORPTION PROCESS. U.S. 2,487,577 (1949) November 8.

The water content of the absorbing medium used to absorb hydrogen sulfide or other acidic materials from gases is held constant by introducing water into the lower part of the stripping column in an amount which is controlled automatically by the temperature in the bottom of the stripping column.

O. T. Bloomer

Transmission

Jennings, G. P. A PIPE-LINE FLOW CONTROLLER FOR PARTIAL LOOPS. *Oil Gas J.* 48, 93, 95 (1949) *November* 17.

A method for controlling the flow of liquid through the two sides of a pipe loop in order to prevent commingling of products at the end of the loop is described. Two flow nozzles having an area ratio exactly proportional to the area ratio of the two lines in the loop are used with a differential pressure recorder to indicate the pressure on the two throats. A gate valve is partially closed to bring the pen of the recorder to zero.

O. T. Bloomer

Miller, P. H. CORROSION PROBLEMS CAN'T BE SOLVED ON A HIT OR MISS BASIS. *Gas Age* 104, 61-62, 86-88, 90 (1949) *November* 10.

This paper emphasizes the importance of a definite corrosion control program in the treatment of corrosion problems.

B. E. Hunt

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Hulcy, D. A. THE EXPANDING HORIZON FOR NATURAL GAS. p. 282

Schwertz, F. A. THE STRUCTURE OF POROUS MATERIALS FROM GAS PENETRATION RATES. p. 296

Wilson, G. M. OIL AND GAS FUEL MIXTURE REDUCES OPERATING COSTS. p. 294

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Coal Extraction

Billheimer, J. S., Yundt, C. G., Sage, B. H. and Lacy, W. N. MULTIPLE CONDENSED PHASES IN THE METHANE-DECANE-TETRALIN-BITUMEN SYSTEM. T.P. 2718. *J. Petroleum Technol.* 1, 265-270 (1949) *October.*

As a part of a general investigation of the separation of bitumen from hydrocarbon mixtures a study was made of a restricted quaternary system composed of methane and a mixture of decane, tetralin and bitumen in fixed relative proportions. The measurements permitted the determination of the distribution of the components in each of the fluid phases. The work was limited to a pressure of 8000 psia and a temperature of 220°F. Gas-liquid equilibrium constants of each component were found to vary markedly with the composition.

O. T. Bloomer

Corrosion

Gardner, F. T., Clothier, A. T. and Coryell, F. AMMONIA USED TO CONTROL VAPOR ZONE CORROSION. *Petroleum Engr.* **21D**, 18, 20 (1949) *November.*

The summarized findings of field tests on the control of corrosive attack of sour crudes in the vapor zone of storage tanks are reported. For a 55,000 bbl tank, the protection efficiency increased from 16 to almost 100% when the ammonia treatment was increased from 1.4 to 15 lb ammonia vapor per tank per day.

B. E. Hunt

Cracking

Barr, F. T. (assigned to Standard Oil Development Co.) HIGH VELOCITY FLUID SOLIDS TECHNIQUE. U.S. 2,483,485 (1949) October 4.

Operation at linear velocities higher than the usual is made possible by using two fluid beds of different particle size. The fines from the lower bed are entrained in the relatively coarse upper bed, the two beds being separated by a screen of proper size. To maintain the fines concentration below 30% in the upper bed, a stream is continuously sent to an elutriator where the fines are separated and returned to the lower bed.

W. J. Merwin

Greensfelder, B. S., Voge, H. H. and Good, G. M. CATALYTIC AND THERMAL CRACKING OF PURE HYDROCARBONS. *Ind. Eng. Chem.* **41**, 2573-2584 (1949) *November.*

The cracking of pure hydrocarbons both with and without catalysts has been considered. Cracking systems can be assigned to two fundamental classes. Two reaction mechanisms are proposed, one a free radical (thermal type) mechanism, the other a carbonium ion (acid-activated) mechanism. Cracking catalysts are available for either type of reaction mechanism. Those which accelerate the free radical type reactions are non-acidic (activated carbon) while those which accelerate carbonium ion type reactions are acidic (commercial natural or synthetic catalysts).

C. H. Riesz

Hepp, H. J., Spessard, F. P. and Randall, J. H. ETHANE PYROLYSIS. *Ind. Eng. Chem.* **41**, 2531-2535 (1949) *November.*

Hydrogen and ethylene were the principal products (about 80% of the cracked gas) from the cracking of ethane at 1700-1900°F in a copper-lined, stainless-steel tube. The concentration of ethylene in the cracked gas increased with increased cracking of ethane to maximum value of 37% at 1800°F and 83% ethane decomposition. Acetylene was present in amounts up to 3.4% and butadiene up to about 1% of the cracked gas. Yields were correlated on the basis of equilibrium dissociation and first-order reaction velocity constants.

C. H. Riesz

Olsen, C. R. and Sterba, M. J. EFFECT OF REACTOR TEMPERATURE ON PRODUCT DISTRIBUTION AND PRODUCT QUALITY IN FLUID CATALYTIC CRACKING. *Chem. Eng. Progress* **45**, 692-700 (1949) *November.*

Pilot plant data obtained by once-through fluid catalytic cracking of a Midcontinent gas oil have been correlated. Synthetic silica-alumina catalyst was used in tests made at reactor temperatures of 800°F, 900°F and 950°F. The general effect of increasing reactor temperature at a given conversion level is to reduce catalyst deposit and yield of debutanized gasoline and to increase the yield of light hydrocarbons. The liquid products contain increased concentrations of unsaturated components and have improved clear octane numbers. In the discussion following the paper, A. L. Conn stated that increased reactor temperature in commercial plants could be achieved only by increasing the catalyst to oil ratio. The net effect results in an increase rather than the indicated decrease of catalyst deposit demonstrated in the pilot plant.

C. H. Riesz

Thomas, C. L. CHEMISTRY OF CRACKING CATALYSTS. *Ind. Eng. Chem.* **41**, 2564-2573 (1949) *November.*

The structure and chemistry of silica and alumina and their combinations leading to catalyst activity for hydrocarbon cracking are considered. The hypothesis is formulated that the active part of the catalyst is formed when one aluminum atom shares four oxygen atoms which are in turn shared by four silicon atoms. The catalytic activity is ascribed to the hydrogen ion associated with the unsatisfied valencies of the four oxygen atoms surrounding the aluminum atom. The active portion of the catalyst is considered to be $(HAlSiO_4)_x$. For maximum activity the atomic ratio of silica to alumina should be one according to the hypothesis; experiments with carefully prepared catalysts indicate that the maximum activity actually occurs at a ratio of two. This difference and others are reconciled by various considerations.

C. H. Riesz

Fischer-Tropsch Synthesis

Clark, A. (assigned to Phillips Petroleum Co.) SYNTHESIS OF HYDROCARBONS. U.S. 2,486,633 (1949) November 1.

For the catalytic synthesis of higher hydrocarbons from carbon monoxide and hydrogen, temperature is controlled by adding 0.002 to 0.0035 pounds of a monohydric alcohol (e.g., methyl, ethyl or amyl alcohol) per Btu of heat removed from the reaction zone.

C. H. Riesz

Voorhies, A., Jr. and Owen, J. J. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS PROCESS CATALYZED BY OXIDIZED AND REDUCED IRON. U.S. 2,483,512 (1949) October 4.

Iron catalyst for the synthesis of hydrocarbons from carbon monoxide and hydrogen is prepared by oxidizing powdered iron to iron oxide at temperatures in the range of 600-900°F. The oxidized iron is then reduced with a mixture of carbon monoxide and hydrogen at temperatures within the range indicated above. The treatments are carried out preferably with a fluidized mass of catalyst.

C. H. Riesz

McAdams, D. R. and Segura, M. A. (assigned to Standard Oil Development Co.) REGENERATION OF IRON TYPE HYDROCARBON SYNTHESIS CATALYST. U.S. 2,487,159 (1949) November 8.

Fluidized iron catalyst used in the synthesis of hydrocarbons from carbon monoxide and hydrogen is regenerated by steaming 4-12 hrs at 800-900°F followed by oxidation at 825-900°F. The regenerated catalyst (which may contain 3 to 5 wt-% carbon) is returned immediately to the reactor.

C. H. Riesz

Walker, S. W. (assigned to Stanolind Oil and Gas Co.) HYDROCARBON SYNTHESIS PROCESS AND CATALYST THEREFOR. U.S. 2,485,945 (1949) October 25.

For the superatmospheric pressure synthesis of hydrocarbons from carbon monoxide and hydrogen, a fluidized iron catalyst is prepared from mill or bloom scale by (a) grinding to 100 mesh and finer, (b) adding an alkali metal compound (e.g., 0.5 to 2% K_2O) and (c) reducing with hydrogen at elevated temperature (e.g., 1200-1400°F). The catalyst has a platelike or laminar form and does not "ball up" or defluidize to the same extent as similar iron catalysts prepared from other sources.

C. H. Riesz

Watson, C. W. (assigned to Texas Company) PROCESS FOR CATALYTIC CONVERSION OF CARBON OXIDES. U.S. 2,486,894 (1949) November 1.

In the superatmospheric pressure synthesis of hydrocarbons from carbon monoxide and hydrogen with a fluidized iron catalyst, carbon dioxide is added to the synthesis gas. The mole ratio of hydrogen to carbon monoxide is at least 2, while the mole ratio of hydrogen to the sum of carbon monoxide plus carbon dioxide is about 0.6. The initial temperature of contact between catalyst and reactants is also maintained some 50 to 100°F lower than the final contact temperature. It is claimed that net production of carbon dioxide and the formation of methane are reduced materially through use of the specified process conditions.

C. H. Riesz

Watson, C. W. (assigned to the Texas Co.) PROCESS FOR CATALYTIC CONVERSION OF CARBON OXIDES. U.S. 2,486,895 (1949) November 1.

In the superatmospheric pressure synthesis of hydrocarbons from carbon monoxide and hydrogen, a fluidized mixture of iron synthesis catalyst and iron water-gas shift catalyst is used. The mole ratio of hydrogen to carbon monoxide is at least 2. Water is added in an amount not to exceed saturation at atmospheric temperature, and carbon dioxide is also added such that the molar ratio

$$[(CO_2)\ (H_2\text{-}2ACO)]/[(CO)\ (H_2O)]$$

is substantially (e.g. 25%) greater than the equilibrium constant for the water-gas shift reaction corresponding to the reactor temperature. In the above molar ratio A is a constant between 0.95 and 0.995 representing the feed carbon monoxide which is to be converted into desired products. It is claimed that net produc-

tion of carbon dioxide is eliminated, conversion of carbon monoxide is substantially complete (95-99.5%) and methane formation is reduced through use of the specified conditions.

C. H. Riesz

Synthesis Gas

Clark, E. L., Kallenberger, R. H., Browne, R. Y. and Phillips, J. R. SYNTHESIS GAS PRODUCTION. *Chem. Eng. Progress* **45**, 651-654 (1949) *November.*

A plant producing about 5.5 Mcf per hr of synthesis gas (2 parts hydrogen, 1 part carbon monoxide by volume) has been constructed at Bruceton, Pa., by the Girdler Corporation. It was demonstrated that the plant can produce as little as 0.48 Mcf per hr of this synthesis gas if required as well as other synthesis gases (e.g., H_2/CO ratio of 1/1). The process consists in the reaction of desulfurized natural gas ($C_{1.17}H_{4.3}$) with steam and carbon dioxide in the presence of nickel catalyst at 1400 to 1700°F. Gases containing up to 85-90% carbon monoxide were prepared by the reaction of natural gas with carbon dioxide, no steam being used. A second plant producing 99% purity hydrogen (not described) was also constructed. Monoethanolamine systems remove excess carbon dioxide and the rich amine solution serves to supply the necessary carbon dioxide. The various gases are to be used in the experimental work by the Bureau of Mines on synthetic fuels.

C. H. Riesz

Gaucher, L. P. (assigned to Texas Co.) CONVERSION OF HYDROCARBON GAS INTO CARBON MONOXIDE AND HYDROGEN. U.S. 2,483,182 (1949) September 27.

In the combustion of natural gas with molecular oxygen to produce synthesis gas, 55 to 85% of the oxygen is mixed with the natural gas and is preheated above 1000°F but below the spontaneous ignition temperature. The remaining oxygen (15-45%) is preheated separately (to 800-1500°F). The two streams are then mixed and, in the presence of a combustion catalyst, carbon monoxide and hydrogen are produced.

C. H. Riesz

Johnson, E. A. (assigned to Standard Oil Co. of Ind.) PROCESS FOR PRODUCING HYDROGEN-CARBON MONOXIDE GAS MIXTURES. U.S. 2,482,187 (1949) September 20.

Hydrogen and carbon monoxide are produced in a fluidized bed of carbonaceous solids such as coal, shale, lignite, peat, and oil sands by passing methane, oxygen, and steam upwards through the bed at a temperature greater than 1500°F. The solids are then sent to a combustion zone where they are heated to incandescence.

W. J. Merwin

Phinney, J. A. (assigned to Stanolind Oil and Gas Co.) PRODUCTION OF CARBON MONOXIDE AND HYDROGEN. U.S. 2,482,866 (1949) September 27.

Natural gas is incompletely burned with oxygen (0.6 mole of oxygen per mole of methane) in a bed of fluidized solid catalyst (e.g., nickel-alumina) at about 1530°F and 30 psig to produce a gas containing about 92% hydrogen and carbon monoxide in a molal ratio of about 2:1.

C. H. Riesz

Synthetic Gasoline

Bruner, F. H. SYNTHETIC GASOLINE FROM NATURAL GAS. *Ind. Eng. Chem.* **41**, 2511-2515 (1949) *November.*

Gasoline synthesized on a pilot-plant scale at the Beacon laboratories of the Texas company has been examined. It was found to be relatively low boiling and highly olefinic in character. The olefins are mainly straight chain with the double bond in the terminal or 1-position. Isomerization of the olefins to more centered positions markedly improved the octane number. The synthetic fuel appeared to blend normally with petroleum products.

C. H. Riesz

Transmission

Wilson, G. M. OIL AND GAS FUEL MIXTURE REDUCES OPERATING COSTS. *World Oil* **129**, 220, 224 (1949) *November.*

The conversion of two single-cylinder, 150 horsepower, four-cycle oil engines to utilize a

fuel consisting of ¾ fuel oil and ¼ natural gas increased power output and reduced maintenance and fuel costs. The discharge pressure of oil pumps driven by the engines was raised from 700 to 850-900 psi and the monthly fuel oil consumption was reduced from 300 to 190 bbls.

A. J. Rudnitzki

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Rall, C. G. and Taliaferro, D. B. A BUREAU OF MINES METHOD FOR DETERMINING POROSITY: A LIST OF POROSITIES OF OIL SANDS. p. 290

7. ANALYTICAL METHODS AND TESTS

Calorimetry

Marskell, W. G. and Rayner, J. E. BENZOIC ACID AS A CALORIMETRIC STANDARD IN THE DETERMINATION OF THE CALORIFIC VALUE OF FUELS. *Fuel* (British) 28, 243-245 (1949) *November.*

Benzoic acid for use as a calorimetric standard should be rigidly defined in terms of such properties as percentage purity, ash content and sharpness of melting point. The authors found maximum differences of 2.5°C in melting point, and 35 cal/gm in calorific value between 7 samples, which were greatly reduced by recrystallization. Bomb samples may be dried and briquetted, or else fused in the bomb capsule with equally precise results, but in any case, storage in a dessicator over H_2SO_4 prior to weighing is recommended.

O. P. Brysch

Infrared Spectrometer

White, J. U. and Liston, M. D. and Simard, R. G. RECORDING INFRARED SPECTROMETER FOR CONTINUOUS ANALYSIS. *Anal. Chem.* 21, 1156-1161 (1949) *October.*

An infrared spectrometer is described which analyzes several constituents of a mixture by consecutive measurement of one selected peak and a reference point for each component. The use of the reference point as an "internal standard" serves to ensure continued accuracy over long periods of operation.

S. Katz

Organic Sulfur

Austin, R. R. THE AUTOMATIC RECORDING TITRATOR AND ITS APPLICATION TO THE CONTINUOUS MEASUREMENT OF THE CONCENTRATION OF ORGANIC SULFUR COMPOUNDS IN GAS STREAMS. Paper presented at the American Gas Association Convention, Chicago, Illinois, October 17-20, 1949.

The author briefly describes the design and operation of the Consolidated Engineering Corporation Titrilog with emphasis on its application to the automatic recording of concentrations of sulfur compounds in gas streams. Continuous automatic titration is achieved by electronic control of reagent generating current. Electrolytically generated bromine is the reagent employed for reaction with the sulfur compounds as they are absorbed from the gas stream by an electrolyte circulated through the titration cell. Sulfur compounds that have been titrated in this manner include: SO_2, H_2S, mercaptans, thioethers, thiophene, and disulfides. It has been found that CO, aldehydes, and ketones do not react with the bromine in the titration cell. The behavior of olefins, diolefins, and acetylene is being investigated at present. The concentrations of the various sulfur compounds making up the total sulfur content of a gas may be determined by removing specific compounds with the use of selective absorbents. Maximum sensitivity for the Titrilog is 0.005 grains of mercaptan sulfur per 100 cu ft of gas and is obtained by operating at the maximum gas flow rate of 2 cu ft per hr. For gases of higher sulfur content sensitivity is a function of the sulfur concentration; thus the sensitivity is 0.1 grain of sulfur in the range from 0-10 grains per 100 cu ft and 1.0 grain in the range from 0-100 grains. Tests under controlled conditions have shown the instrument is capable of absolute accuracy of ±1% and over-all data are believed to be reliable to ±5%. Calibration data for butyl mercaptan and for dimethyl sulfide and

a typical record made in operation on Texas natural gas is reproduced to illustrate the use of the instrument. In a period of 14 months of laboratory and field experience with the Titrilog, the manufacturer claims it has provided dependable analytical records while requiring a minimum amount of maintenance.

H. Hakewill

Abstractor's Note: At present the Consolidated Engineering Corporation is investigating the problems concerning the application of the Titrilog to sulfur analyses in manufactured gases.

Standardization

Brown, R. L. THE PROBLEMS AND TECHNIQUE OF STANDARDIZATION: STATISTICAL METHODS IN INDUSTRY. *Bull. Brit. Coal Utilization Research Assoc.* 13, 261-268 (1949) *August.*

The process of standardization proceeds through the following three steps: (1) research, consisting of the assembling of relevant information and development of a number of techniques for measurement of the necessary properties; (2) standardization, involving simplification of the original proposals and verification of the technique; and (3) interpretation, which establishes the degree of correlation with industrial practice by making evident the limitations of the test. The statistical technique has been found invaluable in each of the three steps, being especially helpful in surveys, planning of investigations, and quality control. Other applications are integration of standards and drafting of commercial specifications. Sixty-four references are given, including classified references to standard statistical literature.

W. E. Ball

Structure Study

Schwertz, F. A. THE STRUCTURE OF POROUS MATERIALS FROM GAS PENETRATION RATES. *J. Applied Phys.* 20, 1070-1075 (1949) *November.*

Gas penetration rates have been used to study the structure of three commercial grades of sintered Pyrex glass. Specific surface areas, "average pore diameters," pore population densities, average particle diameters, and particle population densities have been calculated on the basis of the data obtained.

Author's abstract

Sulfur

Fassina, L. SULFUR CONTENT OF SPENT OXIDE. *Gas J.* (British) 260, 233 (1949) *October* 26.

The author describes a rapid method for the determination of sulfur in spent oxide by extraction with diethyl ether, which selectively dissolves sulfur deposited in spent oxides without affecting coal tars or wood resins which may also be present. An alternative method described depends on the extraction of sulfur with CS_2 utilizing animal charcoal to retain tar dissolved during the extraction process. The use of either of the foregoing methods requires only weighing of the pure sulfur extracted and eliminates the necessity for oxidizing extracted residue to determine the pure sulfur content of the oxide as $BaSO_4$ and the tar content as CO_2 as is normally done.

H. Hakewill

8. GENERAL AND PHYSICAL CHEMISTRY

Catalyst

Brey, W. S., Jr. and Krieger, K. A. THE SURFACE AREA AND CATALYTIC ACTIVITY OF ALUMINUM OXIDE. *J. Am. Chem. Soc.* 71, 3637-3641 (1949) *November.*

The catalytic activity of aluminum oxide, prepared by heating in vacuum and in water vapor at temperatures between 932 and 1832°F, has been determined for the dehydration of ethyl alcohol at reaction temperatures of 662°F and 752°F. Both total activity and specific activity decreased with temperature above 1112°F. Heating in an atmosphere of water vapor induced an additional loss of activity and area, but the specific activity of the surface was nearly independent of the presence of water. Some possible mechanisms were considered and the ether intermediate theory in its simplest form appears inapplicable.

C. H. Riesz

Flame Spectra

Plyler, E. K. and Humphreys, C. J. FLAME SPECTRUM OF ACETYLENE FROM 1 TO 5 MICRONS. *J. Research Natl. Bur. Standards* 42, 567-572 (1949) *June.*

The flame spectrum of acetylene has been studied in the near infrared region. One emission band has been noted which may originate in an acetylene vibration; all other bands probably originate with intermediates or products of combustion.

S. Katz

Reaction Rates

Stevens, W. H. and Attree, R. W. THE EFFECT OF REACTION RATES CAUSED BY THE SUBSTITUTION OF C^{14} FOR C^{12}. PART I. THE ALKALINE HYDROLYSIS OF CARBOXYL-LABELED ETHYL BENZOATE. *Can. J. Research* 27B, 807-812 (1949) *October.*

In a study of the hydrolysis of carboxyl labelled ethyl benzoate, it was observed that substitution of C^{14} for C^{12} shows the reaction rate to 86% of its initial value at room temperature.

S. Katz

Thermodynamics

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART XXIII.—EQUILIBRIUM FLASH VAPORIZATION CORRELATIONS FOR PETROLEUM FRACTIONS. *Petroleum Refiner* 28, 143-150 (1949) *October.*

Equilibrium flash vaporization curves for hydrocarbon mixtures are compared with true boiling point curves and ASTM distillation curves. Empirical correlations relating the curves are presented. The resultant charts may be used to determine the liquid-vapor phase conditions at atmospheric and higher pressures.

S. Katz

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART VI — ACETYLENES AND DIOLEFINS. *Petroleum Refiner* 28, 133-136 (1949) *October.*

The sixth of the series on thermal data of various hydrocarbon groups include the acetylenes and the diolefins. As previously, tables on heat capacities and enthalpies using 273°K as reference state are presented, using four different temperature scales. The data range from 273° to 1500°K. Other tables found in this article are reference sources for these heat capacities, heat of combustion, formation, and free energies at 25°C, mean heat capacities, and the cubic heat capacity equations for the hydrocarbons mentioned above.

S. Mori

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Jones, G. W., Kennedy, R. E. and Spolan, I. EFFECT OF HIGH PRESSURES ON THE FLAMMABILITY OF NATURAL GAS-AIR-NITROGEN MIXTURES. p. 289

9. ORGANIC CHEMISTRY

Oxidation of Hydrocarbons

Rust, F. F. and Vaughan, W. E. OXIDATION OF HYDROCARBONS CATALYZED BY HYDROGEN BROMIDE. *Ind. Eng. Chem.* 41, 2595-2597 (1949) *November.*

Gaseous hydrogen bromide acts as a homogeneous phase catalyst for the oxidation of hydrocarbons with oxygen. As the main reaction, ethane is converted to acetic acid, straight-chain paraffins to ketones, and branched-chain paraffins to stable peroxides. The nature of the product is determined by the most reactive carbon-hydrogen linkage in the molecule. The reactivities of these linkages increase in the order—primary, secondary and tertiary. Carbon-carbon bond scission and operating temperatures are low, and conversions and yields are high.

C. H. Riesz

Bell, E. R., Dickey, F. H., Raley, J. H., Rust, F. F. and Vaughan, W. E. OXIDATION OF BRANCHED-CHAIN COMPOUNDS. *Ind. Eng. Chem.* 41, 2597-2604 (1949) *November.*

The hydrogen bromide-catalyzed oxidation of isobutane, isopentane and related branched-chain compounds gave high yields of organic peroxides. It represents the first isolation in

major amount of organic peroxides formed by the reaction of paraffin hydrocarbons with oxygen.

C. H. Riesz

Nawrocki, P. J., Raley, J. H., Rust, F. F. and Vaughan, W. E. OXIDATION OF ETHANE AND RELATED COMPOUNDS. *Ind. Eng. Chem.* 41, 2604-2608 (1949) *November.*

The hydrogen bromide-catalyzed oxidation of propane, butane and related compounds containing secondary carbon atoms gave ketones in high yield. Thus, propane was converted to acetone in yields as high as 75% of the propane consumed where 75% of the propane was reacted.

C. H. Riesz

Bell, E. R., Irish, G. E., Raley, J. H., Rust, F. F., and Vaughan, W. E. OXIDATION OF ETHANE AND RELATED COMPOUNDS. *Ind. Eng. Chem.* 41, 2609-2612 (1949) *November.*

The hydrogen bromide-catalyzed oxidation of ethane, typifying the oxidation of primary carbon atoms, produced high yields of acetic acid. The acetic acid produced was equivalent to 85-90% of the oxygen fed. Organic bromides (mainly ethyl bromide) are produced as a by-product. Methane is resistant to this type of reaction.

C. H. Riesz

Barnett, B., Bell, E. R., Dickey, F. H., Rust, F. F. and Vaughan, W. E. OXIDATIONS OF AROMATIC COMPOUNDS. *Ind. Eng. Chem.* 41, 2612-2616 (1949) *November.*

The hydrogen bromide-catalyzed oxidation of aromatic hydrocarbons gave the expected acids or ketones when primary or secondary hydrogen atoms on side chains were attacked. The reactions were complicated by the scission of the postulated peroxide intermediates to yield phenol and aliphatic ketones or acids. Benzene was resistant to this type of oxidation.

C. H. Riesz

10. CHEMICAL ENGINEERING

Air Flow

Linden, H. R. and Othmer, D. F. AIR FLOW THROUGH SMALL ORIFICES IN THE VISCOUS REGION. *Trans. Am. Soc. Mech. Engrs.* 71, 765-772 (1949) *October.*

Experimental data for air flow through square-edged circular orifices and their correlation with the pressure difference, the orifice diameter, and the air temperature are presented in nomographic form. The correlation holds well for small orifices with diameters ranging from $\frac{1}{16}$ to $\frac{3}{16}$ in., for pressure differences from 0.015 to 0.500 in. of water, and negligible velocity of approach. The air-temperature range within which the correlation can be applied is from 70° to 300°F, and corrections for barometric pressures from 27 to 32 in. of mercury can be made. The main use of this correlation will be found in its application to oil-burner design. By inclusion of the carbon-hydrogen ratio criterion, the nomographic representation may be integrated with the system of combustion calculations, based upon the carbon-hydrogen ratio developed by the authors. The nomograph enables the designer to calculate the theoretical fuel rate at which any hydrocarbon fuel can be burned per square inch of air-orifice area at a given pressure difference across orifices of known diameter and at specified air temperature, air pressure, and air humidity.

Authors' abstract

Heat Transfer

Donohue, D. A. HEAT TRANSFER AND PRESSURE DROP IN HEAT EXCHANGERS. *Ind. Eng. Chem.* 41, 2499-2511 (1949) *November.*

From a study of previously published data, equations have been developed for determining the coefficient of heat transfer in both baffled and unbaffled shell and tube exchangers. For unbaffled exchangers the Nusselt number is given as a function of a constant multiplied by the Reynolds number to the 0.6 power, Prandtl number to the 0.33 power, and equivalent diameter to the 0.6 power. For any baffled shell, the function is a constant multiplied by the Rey-

nolds number to the 0.6 power, Prandtl to the 0.33 power and ratio of bulk to wall viscosity to the 0.14 power. In the former, mass velocity is that parallel to the tubes through the free cross section, and for the latter, it is the geometric mean of that across the tubes and through the baffle openings. Not all the shell fluid penetrates the tube bundle, small differences in structure making considerable variations in the per cent of total flow penetrating the tube bundle. Relation between h, heat transfer coefficient, and F, friction factor, is shown by a log-log plot of these functions as per cent flow penetration. Slopes are 0.6 and 2, respectively. For the same values of fluid rate and pressure drop, disc and doughnut type baffles showed about 15% higher coefficients than the segmental type.

C. L. Tsaros

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Cost Data

Barnet, W. I. BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS. U.S. Bureau of Mines Information Circular 7516 (1949) October.

This is an annotated bibliography of cost data as presented in seven technical journals of chemical engineering and of the petroleum industry during the period from 1930 to September, 1948.

W. J. Merwin

Materials Handling

Boyle, R. L. MATERIALS HANDLING. *Chem. Ind.* 65, 513-515 (1949) *October.*

New developments in materials handling which have occurred in the past two years are tabulated. These include trucks, conveyors, scales, packers, pilers, and ramps. Each item has its distinguishing characteristics listed, together with the applications and the manufacturer. The air slide is used to convey 225 tons per hr of cement down a 4° slope, at a horsepower requirement of 10% of that for screw conveyors. New developments in conveyors include the Zipper, the Cable-Veyor and the use of steel for belts.

W. J. Merwin

Pressure Vessels

Maccary, R. R. and Fey, R. F. PRACTICAL DESIGN OF PRESTRESSED VESSEL SHELLS. *Chem. Eng.* 56, 120-123 (1949) *October.*

Equations and charts are presented whereby prestressed pressure vessels may be designed. The quantities determined include the core shell dimensions, the thickness of flat ribbon winding required and the tension in the winding as applied. A brief discussion is then given of interlocked ribbon winding, multi-layer construction, spiral construction, auto-frettage and stressing by welding. This is the third and last article of a series on prestressed pressure vessels.

W. J. Merwin

Temperature Measurement

Barefoot, R. B. and Zerban, A. H. FLUE GAS TEMPERATURE MEASUREMENT AT LOW VELOCITIES. *Combustion* 21, 53-54 (1949) *October.*

At low flow rates and in the temperature range 280-750°F, multi-shielded thermocouples indicate true flue gas temperatures. Bare thermocouples in flue gases give satisfactory results only at very high flow rates. By contrast, saturate steam even at low flow rates will yield true temperatures with bare thermocouples. This is attributed to its high convective coefficient of heat transfer and its tendency to heat up the duct wall by condensation, thereby reducing radiation losses.

A. J. Rudnitzki

Thermocouples

McQuillan, M. K. SOME OBSERVATIONS ON THE BEHAVIOR OF PLATINUM/PLATINUM-RHODIUM THERMOCOUPLES AT HIGH TEMPERATURES. *J. Sci. Instruments* (British) 26, 329-331 (1949) *October.*

The effects of heating platinum-rhodium ther-

mocouple wires are discussed. In air appreciable loss of platinum occurs at 1600°C due to oxide formation, and in vacuum platinum is lost through distillation. Very little loss occurs in a hydrogen atmosphere. Deterioration in reducing atmospheres is said to be due to a complex set of events in which carbon, silica and sulfur also participate. It is recommended that silicon-bearing protection tubes be avoided unless steps be taken to eliminate carbon and sulfur.

S. Katz

12. MATERIALS OF CONSTRUCTION

Corrosion

Horst, R. L., Verink, E. D., Jr. and Reid, K. K. CORROSION CONTROL BY LIGHT METAL ANODES—PART III. *Southern Power & Ind.* 67, 74, 76, 78, 80 (1949) *November.*

Procedures are suggested whereby galvanic anodes may be utilized efficiently for controlling pipe line corrosion. Leak records may be utilized by non-technical personnel for installations which will prove satisfactory under a number of conditions.

B. E. Hunt

Pray, H. A., Peoples, R. S., Dalrymple, R. S. and Sims, C. T. THE CORROSION OF MILD STEEL BY THE PRODUCTS OF COMBUSTION OF GASEOUS FUELS. Project DGR-4-CH Report No. 2 to the American Gas Association Committee on Domestic Gas Research, Battelle Memorial Institute, August, 1949.

A description is given of the corrosion testing equipment developed for the testing of materials in the presence of flue gas (with or without sulfur) under a variety of operating and temperature conditions. Corrosion rates have been obtained for SAE 1020 steel at sulfur levels from 0 to 50 grains per 100 cu ft of 1000 Btu gas under conditions of continuous condensation, continuous heating, and cyclic operations where the heating time was kept constant and the cooling period for each cycle varied. The corrosion rates appear to be a function of the length of time at condensation conditions, whether the operation is continuous or cyclic. The rate of penetration decreases markedly as the time of exposure increases up to 100 to 200 hrs until it reaches an essentially constant value.

B. E. Hunt

Materials of Construction

MATERIALS OF CONSTRUCTION. *Ind. Eng. Chem.* 41, 2091-2154 (1949) *October.*

This is the third annual review on materials of construction and represents a summary of the important articles appearing in the literature during the last year. Lead and lead alloys, tin and tin alloys, and less common metals are the new sections present this year. Other subjects covered include: aluminum alloys, carbon and graphite, cements, ceramics, copper, elastomers, fibers, iron, nickel, plastics, hard rubber, stainless steels, and wood.

W. J. Merwin

13. NEW BOOKS

Gas Industry Glossary

Achard, F. H. and Hamilton, E. R. GLOSSARY OF TERMS COMMONLY USED IN THE MANUFACTURED AND MIXED GAS INDUSTRIES. Boston, Drahca Personnel and Training Services, 1948.

The terms used in the manufactured and mixed gas industries are defined in simple, but technically accurate language for the benefit of the non-technical employees of gas companies and allied businesses. The definitions are, in general, more detailed than are given in an average dictionary, and cross-references are liberally employed to give a reasonably complete picture of the relationship between a given term and the various others employed in the same and related phases of the gas industry.

J. C. Lane

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